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Remarks

Extension of Time

A petition and fee extending time for response by two (2) months from August 18, 2010 to October 18, 2010 accompany this response.

Amendments

Claims 3-10, 13-20 and 22-28 are currently in the application for reconsideration.

Independent claims 3, 4, 13, 14 and 22 have been amended to recite two features of Applicant's invention; namely, (i) the antenna elements are separated from the ground plane, as clearly shown in FIG. 2(a) [flag 110 is separated from ground plane 125] and in FIG. 4(a) [flag elements 215 and 210 are both separated from ground plane 225], but the ground plane is in sufficiently close proximity to the antenna elements to cause fast wave excitation of the antenna elements [specification, page 10, lines 23-26].

New claims-26-28 have been added. As described in the specification (page 11, lines 12-21), new claim 26 defines an embodiment of the invention that includes both fast and slow wave antenna elements, with the latter being positioned at a greater distance from the ground plane than the former. Furthermore, as shown in FIG. 2(a), new claim 27 defines an embodiment of the invention in which the distance between the lower edge of the at least one antenna element (110) and the ground plane (125) is tapered. Similarly, as shown in FIG. 4(a), new claim 28 defines an embodiment of the invention in which the distance between the lower edge of the at least two antenna elements (210, 215) and the ground plane (225) is tapered.

As calculated in the transmittal (cover) letter accompanying this response, an amendment fee is also enclosed.

No new matter has been added.

No amendments have been made to the specification or the drawing.

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Claim Objections

In paragraph 2 of the Office action, the Examiner has objected to claim 3, line 6 because "The antenna structure" should be deleted. Applicant's attorney has carefully reviewed claim 3 and cannot find the phrase "The antenna structure" anywhere in the claim and, in particular, cannot locate the phrase at line 6. If the Examiner persists in this objection, it is respectfully requested that he clarify the matter.

Claim Rejections – 35 U.S.C. §102

In paragraph 4 of the Office action, the Examiner has rejected claims 3-7, 9, 13-16, 18 and 20 under 35 U.S.C §102(e) as being anticipated by Wu *et al.* [US Patent No. 6,317,094 issued on November 13, 2001; hereinafter *Wu*]. This rejection is respectfully traversed for any one or more of the following reasons:

(1) **Anticipation:** The law of anticipation under Section 102 is clear, as set forth in MPEP

2131: "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference."

Verdegual Bros. v. Union Oil Co. of California, 2 USPQ2d 1051, 1053 (Fed. Cir.

1987). "The identical invention must be shown in as complete detail as is contained in the ...claim." *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir.

1989). Each and every element of Applicant's claims is not found in Wu, as discussed below.

(2) **Wider Directivity:** As compared with prior art tapered slot antennas, Applicant's invention is characterized by a significant advantage -- wider directivity, which results from a *combination of features*; namely, a symmetrical ground plane within a structure that supports a phase velocity greater than the speed of light. (See, Applicant's specification, page 7, lines 7-25 and page 8, lines 14-26, as well as claims 3, 4, 13, 14 and 22.) As a consequence, as set forth in claims 4, 14 and 22, the overall beam pattern exhibits *both* a cigar-shaped pattern [105(a), FIG. 2(a)] *and* a butterfly wing-like pattern [105(b), FIG. 2(a)]. To provide even wider directivity a slow wave antenna element is incorporated in the structure. (See, Applicant's specification, page 11, lines 12-21 as

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well as claims 22 and 26.) Each of these features is discussed below.

- (3) **Antenna Element-to-Ground Plane Separation:** Independent claims 3, 4, 13, 14 and 22 require at least two structural features not taught by Wu: (i) The antenna elements are *separated* from the ground plane, and (ii) the antenna elements are in sufficiently close proximity to the ground plane to cause *fast wave* excitation ($v > c$) of the antenna elements. In contrast, in Wu's FIG. 23 the fins 314 and 316 are in direct contact with the ground plane; they are not separated from the ground plane as required by Applicant's claims. In addition, Wu's antenna structure 300 (FIG. 23) is a slow wave structure ($v \leq c$), not a fast wave structure.
- (4) **Antenna Phase Velocity:** Each of Applicant's independent claims 3, 4, 13 and 14 recites an antenna structure that includes, *inter alia*, a tapered antenna element comprising "a traveling wave antenna supporting a phase velocity greater than the speed of light." In his rejection of each of these claims the Examiner asserts that column 7, lines 1-14 of Wu teaches this feature. Applicant respectfully disagrees. First, the cited section of Wu discusses the suitability of travelling wave antennas (TWAs) for use in point-to-point communication applications. He points out that leaky wave TWAs, in which the wave travels at a speed $v > c$, produce a main beam other than endfire and are not suitable for point-to-point communications. Wu is *silent* on the phase velocity of the various antennas of his invention except for the substrate-less ($v = c$) embodiment of FIG. 23 described at column 23, lines 3-5. However, Wu's invention is specifically directed to "antennas for use in wireless point-to-point...communication" (col. 1, lines 5-7). Therefore, one skilled in the art would logically conclude that Wu's invention in general (including FIG. 23 specifically) does not constitute a leaky wave antenna since Wu explicitly teaches that such antennas are *not suitable* for such applications. On the other hand, Wu carefully points out that surface wave TWAs, in which the wave propagates at a speed $v \leq c$, do produce endfire radiation and "so can be used for point-to-point communication." Thus, one skilled in the art would logically conclude that the various antennas of Wu's invention (including the tapered slot embodiment of FIG. 23) are surface wave TWAs. Thus, even though Wu is silent regarding the phase velocity of his specific antenna structures (with the exception noted above), one skilled in the art

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would conclude that the wave in Wu's antennas travels at a speed $v \leq c$, contrary to Applicant's claims.

- (5) **Tapered Slot Antennas:** The antennas of Wu's invention constitute tapered slot antennas (TSAs) (col. 1, lines 7-10). The embodiment of FIG. 23 is simply a non-planar design in which the tapered slot 312 lies in a plane not parallel to the ground plate 304 (col. 22, lines 38-49). But, TSAs are "unsuitable for a number of broadband applications, such as in a radio frequency identification ('RFID') polling system, requiring wider directivity than endfire-type devices." (See, Applicant's specification, page 2, lines 9-15, as well as page 3, line 18 to page 7, line 6.) In contrast with the prior art, including Wu, Applicant's unique fast wave antenna structure addresses this deficiency directly. Specifically, Applicant's invention provides the wider directivity needed for polling and similar applications. This improved performance is attained using a new antenna structure, including the features of amended independent claims 3, 4, 13, 14 and 22, as well as newly added dependent claims 26-28.
- (6) **Beam Pattern:** Applicant's claims 4, 14 and 22 specifically require that the antenna structure be configured to support "a cigar-like directional three-dimensional beam pattern and a butterfly wing-like directional three-dimensional beam pattern." The Examiner has cited no specific section of Wu that describes or suggests an antenna structure that generates such a pattern. Yet, this feature gives rise to wider directivity in the embodiments defined by claims 4, 14 and 22.
- (7) **Slow Wave Antenna:** Applicant's claim 20 specifically requires that the antenna structure further includes "a slow wave structure to widen the directivity." The Examiner cites the generic surface wave antenna described briefly at column 7, lines 1-14 of Wu. However, this section of Wu, as discussed above, merely describes the phase velocity and beam characteristics of leaky wave antennas and surface wave antennas in terms of their suitability for use in point-to-point communications. Applicant's unique *combination* of a slow wave antenna and a fast wave antenna is simply not described by Wu and not anticipated under Section 102.
- (8) **Symmetrical Ground Plane:** Each of Applicant's independent claims 3, 4, 13, 14 and 22 recites an antenna structure that includes, *inter alia*, "a symmetrical finite ground

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plane.” In his rejection of each of these claims the Examiner asserts that Wu teaches “a symmetrical finite ground plane [304].” To the contrary, however, ground plate 304 shown in FIG. 23 of Wu is clearly depicted as being rectangular, not symmetrical. Moreover, Wu provides no teaching regarding the shape of the ground plane of FIG. 23, and likewise provides no indication whatsoever that the ground plane is, or should be, symmetrical.

- (9) **Dependent Claims:** Dependent claims 5-12, 15-16, and 18 are patentable at least by virtue of their dependency from independent claims 4 and 14 for the reasons discussed above and incorporated herein by reference.

Claim Rejections – 35 U.S.C. §103

In paragraph 5 of the Office action, the Examiner has rejected claims 8, 17, 22 and 24 under 35 U.S.C §103(a) as being unpatentable over Wu in view of Applicant cited prior art (FIG. 1); namely, the unbalanced impedance shown in the tapered slot antenna of FIG. 1. Since this “prior art” does not overcome the deficiencies of Wu discussed in the traverse of the Section 102 rejection above, claims 8 and 17 are patentable at least by virtue of their dependency from independent claims 4 and 14 for the reasons discussed above and incorporated herein by reference.

In paragraph 7 of the Office action, the Examiner has rejected claims 10, 19, 22-23 and 25 under 35 U.S.C §103(a) as being unpatentable over Wu in view Ogot *et al.* (US Patent No. 5,648,787; hereinafter *Ogot*). Since Ogot does not overcome the deficiencies of Wu discussed in the traverse of the Section 102 rejection above, claims 10 and 19 are patentable at least by virtue of their dependency from independent claims 4, 13 and 14 for the reasons discussed above and incorporated herein by reference.

With respect to both of these obviousness rejections, since claim 22 includes the limitations of claims 13 and 14, claims 22-25 are patentable at least for the reasons discussed above in the traverse of the Section 102 rejection of claims 13 and 14 and incorporated herein by reference.

New Claims 26-28

New claim 26 is dependent from dependent claim 20, which in turn is dependent from independent claims 13 or 14. Therefore, claim 20 is patentable at least by virtue of its dependency

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from independent claims 13 or 14 for the reasons discussed in the traverse of the Section 102 rejection above and incorporated herein by reference. In addition, claim 26 specifically requires "said slow wave antenna is positioned at a greater distance from said ground plane than said antenna elements," which is neither anticipated by nor obvious in view of any art of record.

New claim 27 is multiply dependent from independent claim 3, 4 and 22, and new claim 28 is multiply dependent from independent claims 13 and 14. Therefore, claims 27 and 28 are patentable at least by virtue of their dependency from independent claims 3, 4, 13, 14 or 22 for the reasons discussed in the traverse of the Section 102 rejection above and incorporated herein by reference. In addition, these claims specifically require that the distance between the at least one (two) antenna element(s) and the ground plane is tapered, which is neither anticipated by nor obvious in view of any art of record.

Conclusion

In view of the foregoing, reconsideration of claims 3-10, 13-20 and 22-28, and passage of this application to issue, are hereby respectfully requested. If during the consideration of this paper, the Examiner believes that resolution of the issues raised will be facilitated by further discussion, he is urged to contact the undersigned attorney at 610-691-7710 (voice) or 610-691-8434 (fax).

Respectfully,
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